

## CLAIMS

*Syn O*

1. A photocured crosslinked-hyaluronic acid gel,  
which has a storage modulus ( $G'$ ) of from 50 to 1500 Pa,  
a loss modulus ( $G''$ ) of from 10 to 300 Pa, and a tangent delta  
( $G''/G'$ ) of from 0.1 to 0.8 in dynamic viscoelasticity measured

5 by a rheometer under the following conditions,

method of measurement:

oscillation test method, stress control

measuring temperature: 37°C

measuring geometry: 4 cm

10 gap: 800 μm

frequency: 10 Hz, and

which is a hydrogel obtained by irradiation with  
ultraviolet rays of a photoreactive hyaluronic acid derivative  
in which a photoreactive crosslinking group is chemically  
15 linked to a functional group of the hyaluronic acid and  
crosslinking of mutual photoreactive crosslinking groups.

*AK* *2. The* 2. A photocured crosslinked-hyaluronic acid *gel*,

which has a crosslinking extent of from 0.01 to 0.5%  
per mole of a constituent disaccharide unit of hyaluronic acid

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which is a hydrogel obtained by irradiation with  
ultraviolet rays of a photoreactive hyaluronic acid derivative  
in which a photoreactive crosslinking group is chemically

linked to a functional group of the hyaluronic acid and crosslinking of mutual photoreactive crosslinking groups.

XAB> 3. <sup>The</sup> A photocured crosslinked-hyaluronic acid gel, <sup>a3</sup> which has a water absorption of 2,000 to 15,000% as defined as follows:

water absorption (%) = weight of absorbed water

/weight of dried gel × 100, and

which is a hydrogel obtained by irradiation with ultraviolet rays of a photoreactive hyaluronic acid derivative in which a photoreactive crosslinking group is chemically linked to a functional group of the hyaluronic acid and crosslinking of mutual photoreactive crosslinking groups.

4. The photocured crosslinked-hyaluronic acid gel according to any one of claims 1 to 3,

wherein said photoreactive crosslinking group is a cinnamic acid derivative containing a spacer and chemically links to a functional group of hyaluronic acid to afford said photoreactive hyaluronic acid derivative;

said mutual photoreactive crosslinking groups of said photoreactive hyaluronic acid derivative are dimerized by irradiation with ultraviolet rays to form a cyclobutane ring and to thereby form a network structure; and

said gel is a hydrogel containing an aqueous medium in said network structure.

*A* 4. The photocured crosslinked-hyaluronic acid ~~gel~~ <sup>hydrogel</sup> according to claim <sup>1</sup>, wherein said spacer is a group derived from an amino alcohol, an amino acid or a peptide.

*A* 5. The photocured crosslinked-hyaluronic acid ~~gel~~ <sup>hydrogel</sup> according to claim <sup>4 or 5</sup>, wherein said photoreactive crosslinking group is represented by the following formula (1) or (2):



wherein R<sup>1</sup> and R<sup>2</sup> each independently represents a hydrogen atom or an alkyl group having from 1 to 8 carbon atoms; Ph represents a phenyl group; and n represents an integer of from 2 to 18;



wherein R<sup>3</sup> represents an alkyl group having from 1 to 8 carbon atoms or an aralkyl group; A represents  $-(\text{NHCR}^4\text{R}^5\text{CO})_m-$  or  $-\text{NH}(\text{CR}^4\text{R}^5)_n\text{CO}-$ ; R<sup>4</sup> and R<sup>5</sup> each independently represents a hydrogen atom or an alkyl group having from 1 to 8 carbon atoms; -Ph- represents a para-phenylene group; m represents an integer of from 1 to 6; and n represents an integer of from 1 to 18.

*N* 6. The photocured crosslinked-hyaluronic acid ~~gel~~ <sup>hydrogel</sup> according to <sup>claim</sup> ~~any one of claims 1 to 6~~, wherein said

photoreactive crosslinking group is introduced in a proportion of from 0.05 to 10% per mole of a constituent disaccharide unit.

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18. A photocured crosslinked-hyaluronic acid <sup>hydrogel</sup> gel,

5 which has a storage modulus ( $G'$ ) of from 50 to 1500 Pa, a loss modulus ( $G''$ ) of from 10 to 300 Pa, and a tangent delta ( $G''/G'$ ) of from 0.1 to 0.8 in dynamic viscoelasticity measured by a rheometer under the following conditions,

method of measurement:

10 oscillation test method, stress control

measuring temperature: 37°C

measuring geometry: 4 cm

gap: 800 μm

frequency: 10 Hz, and

15 which is a hydrogel obtained by irradiation with ultraviolet rays of a photoreactive hyaluronic acid derivative in which a photoreactive crosslinking group is chemically linked to a functional group of the hyaluronic acid and crosslinking of mutual photoreactive crosslinking groups and then by a heat treatment of the crosslinked product.

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hydrogel

89. A photocured crosslinked-hyaluronic acid <sup>hydrogel</sup> gel,

which has a storage modulus ( $G'$ ) of from 50 to 1500 Pa, a loss modulus ( $G''$ ) of from 10 to 300 Pa, and a tangent delta ( $G''/G'$ ) of from 0.1 to 0.8 in dynamic viscoelasticity measured

25 by a rheometer under the following conditions,

method of measurement:

oscillation test method, stress control

measuring temperature: 37°C

measuring geometry: 4 cm

gap: 800 µm

frequency: 10 Hz, and

which is a hydrogel obtained by a heat treatment of a photoreactive hyaluronic acid derivative in which a photoreactive crosslinking group is chemically linked to a functional group of the hyaluronic acid, and then by irradiation with the ultraviolet rays of the heated photoreactive hyaluronic acid derivative and crosslinking of mutual photoreactive crosslinking groups.

hydrogel

10 9. A photocured crosslinked-hyaluronic acid gel,

which has a storage modulus ( $G'$ ) of from 50 to 1500 Pa,

15 a loss modulus ( $G''$ ) of from 10 to 300 Pa, and a tangent delta ( $G''/G'$ ) of from 0.1 to 0.8 in dynamic viscoelasticity measured by a rheometer under the following conditions,

method of measurement:

oscillation test method, stress control

20 measuring temperature: 37°C

measuring geometry: 4 cm

gap: 800 µm

frequency: 10 Hz, and

which is a hydrogel obtained by a heat treatment of a photoreactive hyaluronic acid derivative in which a photoreactive crosslinking group is chemically linked to a

functional group of the hyaluronic acid, and then by irradiation with ultraviolet rays of the heated photoreactive hyaluronic acid derivative and crosslinking of mutual photoreactive crosslinking groups, and then by a heat treatment of the crosslinked product again.

10 11. The photocured crosslinked-hyaluronic acid gel according to ~~any one of claims 1 to 10~~ claims 1, 9, 98 and 109, wherein the endotoxin content of the gel is 0.25 endotoxin unit (EU)/g or less.

11 12. A method for preparing a photocured crosslinked-hyaluronic acid ~~gel~~ hydrogel comprising:

irradiating with ultraviolet rays an aqueous medium solution containing from 0.5 to 10% by weight photoreactive hyaluronic acid derivative in which a photoreactive crosslinking group is chemically linked to a functional group of the hyaluronic acid; and

forming an intermolecular and/or intramolecular crosslinking by dimerization of the mutual photoreactive crosslinking groups to provide a network structure.

12 13. The method for preparing a photocured crosslinked-hyaluronic acid ~~gel~~ hydrogel according to claim 12, wherein a heat treatment is conducted before and/or after irradiation with ultraviolet rays of said aqueous medium solution of the photoreactive hyaluronic acid derivative.

13 14. The method for preparing a photocured crosslinked-hyaluronic acid gel according to claim 13, wherein said heat

treatment is conducted at from 100 to 125°C for from 5 to 30 minutes with high pressure steam.

- 14 15. A biomedical material comprising the photocured hydrogel crosslinked-hyaluronic acid <sup>1</sup> gel according to any one of claims 1, 8, 9 and 10.

16. The biomedical material according to claim 15,  
which has an antiadhesive effect.

17. A biomedical material kit comprising a crosslinked hyaluronic acid gel and a container containing said gel in such a state that it can be taken out.

18. The biomedical material kit according to claim 17,  
wherein said container is a container which can push out said  
gel for injection.

18. A biomedical material kit comprising the photocured crosslinked-hyaluronic acid <sup>hydrogel</sup> gel as described in any one of claims <sup>18, 19 and 19</sup> <sup>hydrogel</sup> and a container containing said <sup>hydrogel</sup> gel in such a state that it can be taken out. 16

20. The biomedical material kit according to claim 19,  
wherein said container is a container which can push out said  
~~drogel~~  
gel for injection.

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